Section 12 Water Pollution Control

Tables

12 Water Pollution Control

Water quality is very important and often fragile. While natural environmental processes and controls provide a means, to some extent, for removing pollutants from water, there are definite limits on how much pollution can be assimilated in this manner. It is up to society to provide safeguards to protect and maintain water quality. This may require increased coordination of water quality and water quantity management.

12.1 Introduction

Water is polluted from two sources: natural pollution from geologic contributions and man-caused pollution. Man-caused pollution is from either point or non-point sources.

Point sources contribute pollution from such things as pipe discharges from industrial processes or wastewater treatment plants. Non-point pollution comes from diffuse sources via overland flow and gully erosion. These include pollution from activities such as agricultural related operations, rangeland uses, mining, construction and urban runoff.

12.2 Setting

Passage of the Utah Water Pollution Control Act of 1953 ushered the state into maintaining high quality water resources. The Federal Water Pollution Control Act in 1972 brought about major changes, particularly in the wastewater treatment plant program.

The Utah Water Quality Board has adopted regulations and set water quality standards. These are enforced statewide. Significant progress has been made since 1972 on improving water quality, including the Kanab Creek/Virgin River Basin. However, much more must be accomplished. Existing discharge permittees are shown in Table 12-1.

TABLE 12-1
MUNICIPAL AND INDUSTRIAL WASTEWATER DISCHARGES AND RESPECTIVE RECEIVING STREAMS

Community/Industry	Receiving Stream
Ash Creek (near Hurricane)	Total Containment
Long Valley	Total Containment
Kanab	Total Containment
Springdale[a]	Total Containment
St. George	Virgin River
Interstate Rock Products	Total Containment
Virgin Town Culinary	Total Containment

[a]Includes Zion National Park and town of Rockville.

The Utah Department of Environmental Quality has implemented a plan for the protection of groundwater. This plan is based on an Executive Order issued in 1984 by the governor of Utah. As a result, the *Ground Water Quality Protection Strategy for the State of Utah* was published.

During the process of preparing this strategy, many potential sources of groundwater pollution were examined. These included sources from agricultural operations, various types and methods of waste disposal, various operations such as mining and oil and gas exploration and other potential pollution sources.

The Department of Environmental Quality is in the process of putting this strategy in place. It includes such things as management, regulations, public information and education, legislation and technical assistance. In an effort to protect the groundwater, recharge areas of the Navajo sandstone aquifer have been identified. The delineation of the recharge area, physical extent and quality of groundwater will aid local governments in the planning of future developments and present use impacts on groundwater resources. This still requires the cooperation of local entities, businesses and individuals to make the strategy a success.

Where streams are deeply incised into consolidated rock formations, groundwater flows out of the rock directly into the streams or into unconsolidated material along the watercourse and then into the streams. Some aquifers where high quality water is now found are vulnerable to pollution by the activities of people. The Navajo sandstone aquifer is vulnerable because much of the outcrop area is in highly pervious sandy soil or lava flows. It is also located near populated areas. In these potential recharge areas, the aquifer is exposed to contaminants in precipitation and streamflow and to contaminants left in or on the land. The outcrop areas must be protected if the quality of the Navajo sandstone aquifer water is to be preserved. Some areas, such as Snow Canyon State Park, are already protected. Other areas, such as City Creek, Middleton Wash, Mill Creek and Kanab Creek, are vulnerable.

Alluvial aquifers are also vulnerable to pollution; in some cases, they have already been adversely affected by the activities of people. These shallow aquifers must also be protected. Recharge areas for the Navajo sandstone have been mapped in Kane and Washington counties by the U.S. Geological Survey in cooperation with the Division of Water Quality (See Figure 9-2). The study was also funded cooperatively by the Kanab Area Water Association, Kane County, Kanab City and Garkane Power Association, Inc. The Five County Association of Governments pledged technical assistance for contract coordination and for planning and zoning.

As a result of this study, the following steps could be taken:

- classify groundwater and aquifers,
- revise land use in the county master plan to protect recharge areas,
- incorporate water quality and watershed protection in the Bureau of Land Management resource management plans,
- consider "sole source aquifer" designation.

12.3 Policy Issues and Recommendations

Two issues are involved in water pollution. The following are discussions and recommendations.

12.3.1 Water Quality Management Plan

Issue - The areawide water quality management plan for southwestern Utah, prepared a number of years ago, is now outdated.

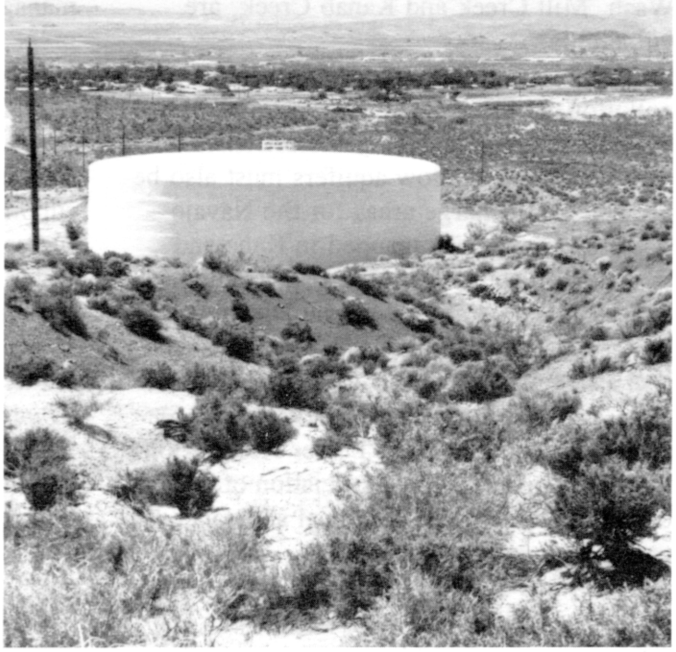
Discussion - As the population increases, so does the demand for high quality water . This is particularly true for culinary water supplies. The demand for water-based recreation will also increase. Agricultural water use should also be protected.

Recommendation - The Division of Water Quality, with assistance from other entities as needed, should update the *Five-County Areawide Water Quality Management Plan* to reflect current problems and solutions.

12.3.2 Local Aquifer Water Quality Protection and Management Plans

Issue - Preparation and implementation of "Local Aquifer Protection and Management Plans" is needed.

Discussion - Most groundwater use is currently diverted to meet municipal and industrial requirements. This use is expected to increase in the future. This could result in large overdrafts from groundwater aquifers, particularly in the Navajo sandstone formation. As a result, water quality could deteriorate at an increasing rate. Measures should be taken to prevent this.



State programs are not comprehensive enough to cover all activities which can be sources of groundwater contamination. The many activities leading to pollution of groundwater suggest it will be difficult in the future to maintain the high quality of water most of the people enjoy unless more care is taken by each municipality to protect its aquifers, wells and springs. Recharge areas in the Navajo sandstone aquifer should be designated as environmentally sensitive. Recharge areas for the Navajo sandstone aquifer were mapped by the Division of Water Quality in cooperation with the U.S. Geological Survey for Kane and Washington counties. These areas for Washington County are shown in Figure 9-2.

Recommendation - The Division of Water Quality and other appropriate entities should continue to study the groundwater resources to determine existing conditions. The Five County Association of Governments and local government agencies should work with the Division of Water Quality and other appropriate agencies to develop and implement local groundwater management and protection programs.

12.4 Local Regulatory Organizations

Towns, cities and counties have primary responsibilities for water pollution control within their respective entities. These responsibilities and authorities are contained in Sections 10, 11, 17, 19, and 73 of the *Utah Code Annotated, 1953, amended.*

In addition, the Board of Health, Southwest Utah Public Health Department, has responsibilities for controlling public waste water, water pollution, septic tank installation and construction and vector, i.e. mosquito control. These responsibilities and duties are carried out through their staff. They work closely with the Utah Department of Environmental Quality on related regulations.

12.5 Water Quality Problems

The Five County Association of Governments and others have reports and data on the areas' water quality. These should be studied by those interested for more detailed information than is presented in this report.

Historically, water quality and water quantity have been under separate jurisdictions. Changing conditions will impact this relationship. Increasing populations will require more high quality water to meet their needs. There will also be more water quality problems associated with increased recreational activities. This will require those concerned with water quality to work more closely with administrators of water rights. Eventually, close coordination will be required as one will directly influence the other.

Streams in the basin flow from areas considerably different from each other in geology, land use, vegetation, altitude and climate. Water quality is measurably affected by these differences. Minerals dissolved in water are determined by rock and soil composition, climate, biological effects of plants and animals and water management and use as the water flows downstream.

Geologic pollution of surface water comes from areas where sediments are eroded from the land surface and washed into streams and rivers. These contain various chemicals depending on the source. Contamination of groundwater occurs as it moves through bedrock aquifers leaching out chemicals. This type of pollution is difficult to control. Natural erosion levels are high because of low vegetative densities, steep gradients and unstable substrates. Erosion contributes to increased salinity, concentration of trace elements, turbidity, sediment loading and biological oxygen demand.

Basin water quality problems are caused primarily by natural geologic and specific non-point sources. The water quality in the mountains is good compared to the lower elevation stream reaches.

Streams and lakes in the state of Utah are assigned water quality standards for maximum contaminant levels according to their established beneficial use designations. These standards are compared against the available water quality data to determine which parameters are exceeding the standards.

Virgin River[1,2,3,4,5] - Soluble salts are the main component of total dissolved solids (TDS) in streams. The highest TDS values on the East Fork of the Virgin River occur at a station south of Mt. Carmel Junction. The values there range from 396 to 1,986 mg/l and average 702 mg/l. The TDS values on the North Fork of the Virgin River and North, Ash and La Verkin creeks are below the standard of 1,200 mg/l for agricultural waters. The TDS values on the Santa Clara River at the station above the confluence with the Virgin River range from 302 to 2,138 mg/l. At that station, the average TDS value is 1,347 mg/l. The average TDS values on the Virgin River exceed the state standards at all stations downstream from and including La Verkin

Springs. The average values at those stations range from 1,459 to 1,898 mg/l. La Verkin Springs contributes water to the Virgin River with a TDS of about 9,000 mg/l.

La Verkin Springs presents a rather peculiar problem. The 9,000 mg/l of total dissolved solids produces downstream effects on agricultural, municipal and industrial and fish habitat uses.[1,2,7] These springs yield nearly 15 percent of the St. George and Washington Fields Canal Company diversion right. This salty water, when applied to irrigated cropland, requires leaching to keep the land in production. It also reduces crop yields.

The salty water reduces the woundfin minnow habitat. Conversely, the water is needed to maintain the instream flow. The high saline content makes it prohibitive to treat the water for culinary uses. Uses for industrial purposes are also unrealistic. Studies have investigated several alternatives to solve this saline water problem. So far, none of the alternatives studied has been cost effective. A new study has been proposed, but little progress has been made. See Section 9.7.5.

Samples collected from 19 springs and one well in the drainage of the East Fork of the Virgin River have a range in total dissolved solids from 145 to 2,703 mg/l and a range in hardness of 124 to 1,819 mg/l. The median values of these 20 samples (10 had less, 10 had more) were 450 mg/l for total dissolved solids and 350 mg/l for hardness.

The best water in the East Fork of the Virgin River drainage comes from springs in the Cretaceous sandstones and from a spring in the Claron Wasatch formation. Nine of the 15 samples collected from springs issuing from the Cretaceous sandstones have less than 425 mg/l total dissolved solids, although seven are very hard and two are hard. These nine samples probably come from the Kaiparowits or Wahweap sandstones and are low in all constituents except calcium and magnesium carbonate. Two of the samples, one from Big Springs in Lydias Canyon and one from the campground spring on US 89 which respectively contain 180 and 145 mg/l total solids, are of water as good or better than the water from the Navajo sandstone aquifer. The only sample from the Claron Formation contains 287 mg/l total solids and has a hardness of 278 mg/l. Five of the other six samples, probably from the Wahweap or Straight Cliffs sandstones, contain between 511 and 690 mg/l total solids. One of these samples, possibly due to surface contamination, contains more than 2,700 mg/l total solids. In addition to being very hard, the five samples contain 116 to 196 mg/l sulfates, appreciably more than the nine samples from the Kaiparowits and Wahweap sandstones.

One sample was collected from a spring, probably in the Tropic shale, in Dry Wash. It contained 527 mg/l total solids, was very hard and had 132 mg/l sulfate.

Two samples of poor quality water were collected from the Carmel formation in Spring Hollow and Red Hollow. These samples contained 809 and 1,017 mg/l total solids and sulfates of 258 and 458 mg/l. These waters are satisfactory for their present use of stock watering.

The only sample collected from a well in this drainage represents some of the poorest water of the area, yet the water used for municipal supplies in Mt. Carmel. This sample contained 1,825 mg/l total solids and

One other sample from a well in this drainage was collected by Nevada Power Company. This water, probably from alluvium, contained 750 mg/l total solids and is harder than most spring water in the vicinity. With adequate treatment it would be satisfactory for domestic use.

Iron readings occasionally exceed the state standard of 1.0 mg/l at two locations on the North Fork of the Virgin River. The readings reach 8.7 mg/l with an average of 1.01 mg/l on the North Fork of the Virgin River at the station above the confluence with the West Fork of the North Fork. Iron readings on Ash Creek near Toquerville range from 0.03 to 4.9 mg/l with an average value of 0.77 mg/l.

Kanab Creek and Johnson Wash[1,3,4] - According to H.D. Goode, all waters sampled in the upper and lower Kanab Creek areas were hard to very hard, but contained less than 500 mg/l total solids. None of these waters contained excessive quantities of silica, sulfate, chloride or iron. However, the excessive hardness of all but the sample from the Navajo sandstone in the lower Kanab drainage suggests that this water should be treated before being used for domestic, public and most industrial needs.

The groundwater from the Navajo sandstone in lower Kanab Creek is comparable to the water sampled from the Kanab City well in Three Lakes Canyon. This water is acceptable for culinary use.

The two samples from the Tropic shale near Alton are harder than any other surface samples from this drainage, and both contain more than 400 mg/l total solids. The evident similarity of the two samples in all constituents except sulfate supports the idea they have a common source.

The other four samples near Alton probably all come from Cretaceous sandstone; their range in total solids, 277 to 462 mg/l, and in other constituents can probably be attributed to the differences in the kinds and thickness of rocks through which the waters percolated before appearing as springs.

The high total dissolved solids in the samples collected by Nevada Power Company from wells 1 and 2 near Alton indicate three of the four samples came from formations containing large quantities of sulfate, presumably the Curtis or Winsor formations which contain gypsum. The fourth sample, although also containing appreciable sulfate, came from a source of better water, presumably the upper part of the Navajo sandstone. Water from this source lower in the Navajo sandstone, as indicated by the water from the Kanab City well and from the spring near lower Kanab Creek, is of better quality. See Section 11.7.

Samples from wells in Johnson Wash contained 1,227 and 790 mg/l total solids and both were high in sulfate. These waters are satisfactory for their present use, irrigation and stock watering.

A one time sampling event at several locations on streams in the basin shows the concentration of trace elements to be above standards in some locations. These include concentrations of lead, cadmium, mercury, chromium, copper and silver. More data is needed to evaluate trace elements in the basin.

12.6 Water Quality Needs

Naturally occurring processes in the Kanab Creek/Virgin River Basin affect water quality. In addition to this, recent and future growth and development will create changes in water use and water quality. To adequately analyze water in the basin, the following ongoing water quality planning and monitoring programs are needed.

1) Routine and intensive monitoring should be continued. More emphasis should be placed on seasonal and episodic event sampling since data is deficient in that area. Additional monitoring is needed where there are no precisely identified sources of pollution.

2) A detailed inventory of severely eroding watersheds is needed. This will provide a base for monitoring of best management practices (BMPs) applied to critical areas such as the Muddy Creek Watershed. The impact of management practices should be refined as additional data become available. Testing on surface water as well as groundwater is needed to determine if nutrient (fertilizer) and/or pesticide contamination has occurred, especially in vulnerable areas such as Washington Fields.

3) Further studies and sampling are required on lakes and reservoirs, of water quality near mines and geothermal wells and on contribution of TDS from groundwater movement in local aquifers. St. George basin urban runoff problems will need to be more extensively studied if anticipated population increases occur.

4) Monitoring can help determine contamination due to faulty septic tanks and the extent of contamination and sources due to leaking underground storage tanks.

5) Riparian vegetation needs to be re-established along portions of the river corridors where recreational impacts and grazing have destroyed the vegetation and compacted the soils. These impacts increase runoff that in turn increases salt and suspended solid yields in the streams.

12.7 Alternative Solutions

In the Kanab Creek/Virgin River Basin, non-point sources are the biggest contributor to water pollution. These sources are primarily geologic, but many are man-caused. Also, local government entities should work with state agencies to implement local groundwater protection programs.

Pollution caused by man's activities can be controlled or at least reduced. Landfills should be controlled by elected officials and located in areas where runoff or leaching will not contaminate water supplies. Controls on construction and other land surface disturbances will reduce pollution.

Where land cover has been depleted, (for example, from domestic livestock or wild animals) practices to re-establish vegetation will reduce erosion and the resulting pollution.

The Colorado River Basin Salinity Control Act was passed to provide financial and technical assistance to reduce salinity levels in the Colorado River Basin. Most of the current activities are directed toward agricultural non-point pollution problems. A more detailed discussion is found in Section 6.7. ■

12.8 References

1. Cordova, R.M. *Ground-Water Conditions in the Upper Virgin River and Kanab Creek Basins Area, Utah, with Emphasis on the Navajo Sandstone.* Technical Publication No. 70, Prepared by the U.S. Geological Survey in cooperation with the Utah Department of Natural Resources, Division of Water Rights, Salt Lake City, Utah, 1981.

2. Damery, Wm. E. *Local Ground Water Protection.* Division of Water Quality, GW Brochure #3, Salt Lake City, Utah, 1991.

3. Goode, Harry D. *Reconnaissance of Water Resources of a Part of Western Kane County, Utah.* Utah Geological and Mineralogical Survey Water-Resources Bulletin 5, Salt Lake City, Utah, 1964.

4. Ibid. *Second Reconnaissance of Water Resources in Western Kane County, Utah.* Utah Geological and Mineralogical Survey Water-Resources Bulletin 8, Salt Lake City, Utah, 1966.

5. Sandberg, George W. and LaVerne G. Sultz. *Reconnaissance of the Quality of Surface Water in the Upper Virgin River Basin, Utah, Arizona, and Nevada, 1981-82.* Technical Publication No. 83, prepared by the U.S. Geological Survey in cooperation with the Utah Department of Natural Resources, Division of Water Rights, Salt Lake City, Utah, 1985.

6. U.S. Department of Agriculture, Soil Conservation Service and Utah Department of Natural Resources, Division of Water Resources. *Virgin River Basin - Utah Cooperative Study.* Salt Lake City, Utah, 1990.

7. U. S. Department of Interior, Bureau of Reclamation. *La Verkin Springs Unit, Utah, Concluding Report.* Boulder City, Nevada, 1981.